Infection Control: Surgical Site Infections

Infectious Disease Epidemiology Section
Office of Public Health
Louisiana Dept of Health & Hospitals
800-256-2748
www.oph.dhh.louisiana.gov

Your taxes at work

Source of Infection

SSI Sources

- Endogenous
  - Patient's own flora at site
  - Flora at contiguous to site
- Exogenous from
  - Hospital environment
  - Medical personnel

- Concordance between bacteria isolated from site intra-operatively and bacteria causing SSI is low (41%)

Endogenous SSI

- Majority of SSI
- Staph au and Staph CoagNeg
- Present on skin, directly introduced in SS by incision or manipulations
- Cleansing & skin degerming useful BUT difficult for
  - Heavily colonized sites
  - Unclean sites

- Distant colonization may play role
  - Wiley AM 1979, Clin Orthop 139: 150
  - Human albumin microspheres (HAM) ~ human skin squames
  - Found in SS from distant sites

Exogenous SSI: HCW

- From hands of surgeon by direct inoculation
- Glove perforations no role (Dodds RDA 1988, Br J Surg 75: 966)
- HAM showed some migration
  - From hair & scalp
  - From inside surgical mask unless hood present
  - From face and nostrils, increased by talking

- Very few outbreaks /SSI related to hair /scalp flora or URT flora

Exogenous SSI: Environment

- Atypical mycobacteria
  - Ubiquitous in hospital environment
  - Very rare in SSI
  - Usually linked to solute contamination

Exogenous SSI: Air

- HCW are main source of airborne particles
- HAM showed migration from URT o SS
- Few outbreaks of βhem. Strep SSI:
  - Ancillary personnel
  - Excise from anal / genital carrier ⇨ air contamination
- Studies of laminar airflow and UV protection ⇨ effective protection in super clean SS
- In other SS air contamination plays minor role

Definitions

Clean /Contaminated

- Clean site:
  - No inflammation
  - No penetration of
  - Closed or with closed drainage
- Clean Contaminated site:
  - Respiratory, GI, genital or urinary tracts entered under controlled conditions with no unusual contamination
  - Specific site: biliary tract, appendix, vaginal, oropharynx
- Contaminated site:
  - Accidental wound with major breach in asepsis
  - Wound with massive GI spill
  - Sites entered with urinary, biliary infection, acute non-purulent infection
- Dirty & Infected:
  - Old wound with devitalized tissue, foreign bodies, fecal contamination
  - Perforated viscus
  - Pus

Classification

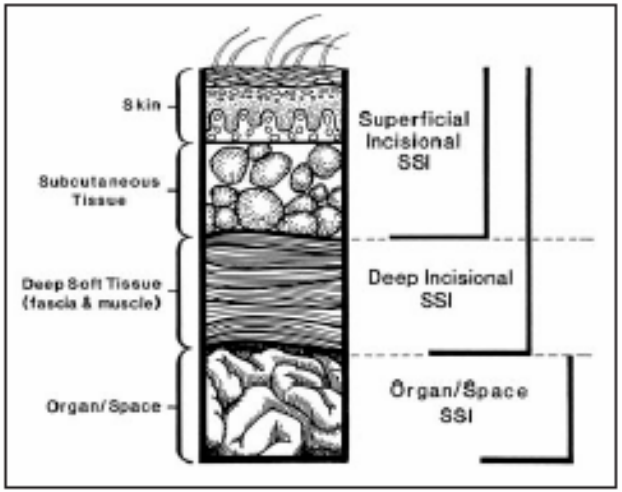

FIGURE. Cross-section of abdominal wall depicting CDC classifications of surgical site infection.[22]

Infection occurs within 30 days after the operation

if no implant† is left in place

or

within 1 year if implant is in place and the infection appears to be related to the operation

Superficial SSI

- **PURULENT DRAINAGE from superficial incision (Culture not indispensable)**

or

- **Positive culture from a closed surgical site obtained aseptically**

or

- **One of : Pain or tenderness, localized swelling, redness, heat, wound dehiscence, abscess**
- **and of infection and wound reopening**

or

- **Medical diagnosis of SSI**

Not Superficial SSI

Stitch abscess

Episiotomy, circumcision infection (not operative figures)

Infected burn wound

Deep Incisional SSI

- Infection involves deep soft tissues (e.g., fascial and muscle layers)

and **at least** ***one*** **of the following:**

- 1. Purulent drainage from deep incision but not from organ/space
- 2. Deep incision dehiscence or opened by surgeon when patient has at least one of: fever (>38°C), localized pain, or tenderness, unless site is culture-negative
- 3. Abscess or other evidence of infection of deep incision on direct examination, reoperation, histopathologic or radiologic exam
- 4. Diagnosis of a deep incisional SSI by physician

1. Report infection that involves both superficial and deep incision sites as deep incisional SSI

2. Report an organ/space SSI that drains through the incision as a deep incisional SSI

Organ /Space SSI

- Infection involves organs or spaces (other than incision) opened or manipulated during an operation

  and at least *one* of the following:

- 1. Purulent drainage from a drain that is placed through a stab wound‡ into the organ/space

- 2. Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space

- 3. An abscess or other evidence of infection organ/space on direct examination, reoperation, histopathologic or radiologic examination

- 4. Diagnosis of an organ/space SSI by physician.

Risk Factors

Risk Factors

- Dose of bacterial contamination
- Virulence of microorganism
- Resistance of host
- Condition of surgical site

Personal Risk Factors

- Advanced age
- Obesity, diabetes, malignancy, immuno-suppressive Tx
- ASA (American Society of Anesthesiologists) physical status

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1. Normal healthy patient
2. Patient with mild systemic disease that is not incapacitating
3. Patient with severe systemic disease that limits activity but is not incapacitating
4. Patient with incapacitating systemic disease that is a constant threat to life
5. Moribund patient who is not expected to survive with or without an operation

SENIC / NNIS Risk Factors

- SENIC =Study of the Efficacy of Nosocomial Infection Control
- NNIS = National Nosocomial Infections Surveillance system

- Location of operation (abdominal)
- Duration > 2 hrs
- Patient clinical status: 3 or more diagnoses on discharge
- ASA index

SSI Rates & Type of Site, NNIS Risk Index

Type of Site	NNIS Risk Index				Total
	0	1	2	3	
Clean	1.1	2.2	4.9	---	2.0
Clean contaminated	2.1	3.3	6.6	---	2.8
Contaminated	---	4.3	5.5	10.5	5.7
Dirty	---	4.2	7.0	11.0	6.6
Total	1.6	2.6	5.6	10.7	2.6

Technical Risk Factors

- **Length of stay, using multi-variate analysis**
  - **1 day=6 % ⇔21 days 15 %** (NRC 1964, Ann Surg 160S)
  - **Mechanism undetermined**

- **Preoperative shave**
  - **Depilatory=0.6 % ⇔Razor within 24 hrs =5.6 %** (Seropian R 1971, Am J Surg 121:251)
  - **Razor causes cross skin cuts, increase colonization**

- **Length of operation**
  - **1hr=1.3% ⇔ 2hrs=2.7% ⇔ 3hrs=3.6% (Cruse 1980. Surg Clin North Am 60:27)**
  - **Mechanism: ⇧ contamination, ⇧ tissue damage, ⇧ suture, ⇧ blood loss & shock**

Technical Risk Factors

- Surgical technique
  - Traction on tissue, bleeding control, removal of dead tissue, break in aseptic technique
  - Surgeons with high volume have lower rates
- Remote infections (URTI, LRTI) role questionable
- Surgical drains role questionable

Incidence

Incidence

- In USA 27 million surgical interventions
- SSI 2-5%
- Most common nosocomial infections after UTI

- Stratified
  - Clean 2 %
  - Clean/Contaminated 3 %
  - Contaminated 6 %
  - Dirty 7 %

Microbes

SSI Agents

- Staph au and Staph CoagNeg from clean sites
- Polymicrobial from respiratory, GI, gyneco, … with aero/anaerobic mix
- Shift to antibiotic resistant strains
- Shift to fungi and unusual bacteria:
  - Candida, Rhizopus
  - Mycobacteria
  - Rhodococcus

NNIS 1990-1992

E.coli	8%
Enterococci	12%
Pse. aeruginosa	8%
Candida	3%
Klebs. pneumo	3%
Enterobacter	7%
Proteus	3%
StaphCoagNeg	14%
Staph. au	19%
Strep	3%

Prevention